6060A

SYNTHESIZED RF SIGNAL GENERATOR

IEEE-488 Quick Reference

FLUKE®

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IEEE-488 ADDRESS

The IEEE-488 Address is determined by the positions of the IEEE-488 INTERFACE switches a1 through a5. The switches represent a right hand justified binary code for 0 through 31. Valid Address codes are 0-30. Do not use Address 31 since this is a special code.

Press the SPCL pushswitch then the DATA 1,0 push switches to display the IEEE-488 Address. The Address will appear in the FREQUENCY Display as a number with the base ten.

The 6060A operates in the LISTEN ONLY or TALK ONLY mode if the LISTEN ONLY (switch 7) or the TALK ONLY (switch 6) is in the "1" position (ON) when power is turned on. The unit will be in the TALK ONLY mode if both switches are on.

IEEE-488 INTERFACE FUNCTIONS SUPPORTED

FUNCTION	DESCRIPTION
SH1	Complete source handshake capability.
AH1	Complete acceptor handshake capability.
T5	Basic Talker, Serial Poll, Talk Only, Unaddressed if MLA.
L3	Basic Listener, Listen Only, Unaddressed if MTA.
SR1	Complete service request capability.
RL1	Complete Remote/Local capability.
PP0	No Parallel Poll capability.
DC1	Complete Device Clear capability.
DT1	Complete device trigger.
C0	No controller functions.
E2	Tri-state drivers.

DEVICE DEPENDENT PROTOCOL

There are four general forms of 6060A device dependent messages:

1. <HEADER>
2. <HEADER> <DATA>
3. <HEADER> <DATA> <SUFFIX>
4. <HEADER> <SUFFIX>

Where:

1. HEADER is one or two ASCII characters that define the type of message.
2. DATA is one of five possible entries that modify the header or that provide related information:
   a. Boolean Data: 0 or 1 indicate the OFF or ON state, respectively.
   b. Unsigned integer (it is understood that, for the 6060A the number is hexadecimal if the left hand character is an X).
   c. Floating Point Data: It is understood that, for the 6060A the power-of-ten to which the stated number is raised follows the designator E unless the power-of-ten is a plus one. Neither the designator E nor the power-of-ten is stated if the power-of-ten is a plus one. For example, 123E-6 is 0.000123 and 123E3 is 123.000, but 123 is 123.
   d. Special Function: The 6060A Special Functions may be used with the SP header without using a suffix.
   e. String record: This numeric is used with the CT (Configure Trigger) message only.

DEVICE DEPENDENT PROTOCOL (cont)

3. SUFFIX is one of six possible entries that modify the header or the data or that provide additional information:
   a. Amplitude Units: V=volts
      MV=millivolts
      UV=microvolts
      NV=nanovolts
      DB=dB or dBm
      MV=millivolts
   b. Frequency Units: GZ=gigahertz
      MZ=megahertz
      KZ=kilohertz
      HZ=hertz
   c. Bit designators: Alpha characters that refers to hardware bits used with IB or OB header.
   d. AM Depth Units: PC = %
   e. LI or LM strings which are coded numeric representations of the front panel setup.
   f. DAC suffix designator: This suffix is used only with the OD (Output DAC bits) message.

The instrument recognizes both upper and lower case characters, but treats all characters as if they were upper case. For example, the instrument interprets mv, mV, or MV all as being MV.

The instrument ignores spaces and tabs.

The instrument recognizes two types of command terminators: string terminators (, or ;) and record terminators (CR, LF, or EOI). String terminators are ignored during normal operation, but are used for synchronization purposes during syntax error recovery. During syntax error recovery, everything is discarded starting with the wrong command and ending with the next end of string (EOS) or the next end of record (EOR) terminator. End of record terminators cause command records to be processed when the instrument is in the Record IEEE-488 Interface Mode. CR and LF are mutually exclusive; either one or the other can be designeated as the EOR character. The instrument ignores the character not designated as the EOR character.

FUNCTION	COMMAND HEADERS
Amplitude Entry	AP, SP3x, RA, SP8x, SP9x
Binary Learn Commands	LI, LM
Clear Commands	CB, CE, CL
Edit Entry	AB, DB, FB, PB, KB, KA, KD, KF, KP
Frequency Entry	FR, SP2x, RF
Interface Mode Commands	EM, RM, TM, VM, UM, @
Interrogate Commands	ID, IE, II, IO, IR, IT, IU, IV
Memory Entry	RC, ST, SQ
Modulation Entry	AM, AE, AI, FM, FE, FI, MR, MF
Monitor Commands	IB, OB, OD, RB, RW, DW, WB, WW, XA, XB, XD, XR
RF ON/OFF Entry	RO
Special Function Entry	SP
SRQ Commands	IM, SM, XF
Step Entry	FS, LS, PS, DS, SU, SD, FU, FD, LU, LD, PU, PD, DU, DD
Trigger Commands	CT, TR

IEEE-488 COMMANDS

COMMAND USE	COMMAND			COMMENTS
	HEADER	NUMERIC	SUFFIX	
AMPLITUDE ENTRY				
Program Amplitude	AP	float	V MV UV NV DB	Program displayed amplitude in units of: volts millivolts microvolts nanovolts dB or dBm
Convert Amplitude Units	AP	none	V MV UV NV DB	Change amplitude units to: volts volts volts volts dB or dBm
Relative Amplitude	SP	30/31	none	Disable/enable relative amplitude operation
Relative Amplitude	RA	0/1		Alternate programming command for disable/enable relative amplitude operation.
Level Correction	SP	80 81 82	none	Enable all level correction. Disable all level correction. Disable attenuator correction.
Amplitude Fixed Range	SP	90/91	none	Disable/enable amplitude fixed-range operation.
BINARY LEARN COMMANDS				
Store a Front Panel Setup	LI	int	string	The Generator stores the string into the memory location specified by int. See the Command Description paragraph* for decoding the learn string.
Send a Front Panel Setup	LM	int	none	The Generator responds with the contents of the memory location specified by int. See the Command Descriptions paragraph* for decoding the learn string.
FREQUENCY ENTRY				
Frequency Programming	FR	float	GZ MZ KZ HZ	Program displayed frequency in units of: gigahertz megahertz kilohertz hertz
Relative Frequency	SP	20/21	none	Disable/enable relative frequency operation.
Relative Frequency	RF	0/1	none	Alternate programming command for disable/enable relative frequency operation.

** Refer to paragraph numbers in 6060A Manual.*

IEEE-488 COMMANDS (cont)

COMMAND USE	COMMAND			COMMENTS
	HEADER	NUMERIC	SUFFIX	
INTERFACE MODE COMMANDS				
Error Mode	EM	0/1	none	Disable/enable the clear error mode. If disabled, the IEEE-488 error status is cleared only when interrogated. If enabled, the error status is cleared when a new message is processed.
Record Mode	RM	0/1	none	Disable/enable the record mode. If disabled, the message unit is a command. If enabled, a message unit is a record. The message unit is the smallest group of characters that the Generator processes.
Record Terminator Mode	TM	0/1	none	Selects the LF/CR character as the record terminator. The record terminator is used on input in the record mode and is sent following all output.
Output Valid Mode	VM	0/1	none	Disable/enable the output valid mode. In the output valid mode, the Generator waits to process commands until the RF output has become valid.
Unbuffered Mode	UM	0/1	none	Disable/enable the unbuffered mode. If disabled, all input is buffered. If enabled, only one message unit is buffered.
"@" Modes	@	int	none	The "@" command may be used as an alternate method of programming interface modes.
STEP ENTRY				
Program FREQ STEP Size	FS	float	GZ gigahertz MZ megahertz KZ kilohertz HZ hertz	Program frequency step size in units of:
Program AMPL STEP Size	LS	float	V volts MV millivolts UV microvolts NV nanovolts DB dB	Program amplitude step size in units of:

IEEE-488 COMMANDS (cont)

COMMAND USE	COMMAND			COMMENTS
	HEADER	NUMERIC	SUFFIX	
Program AM STEP Size	PS	float	PC	Program AM step size in percent.
Program FM STEP Size	DS	float	GZ MZ KZ HZ	Program FM step size in units of: gigahertz megahertz kilohertz hertz
Step Up/Down	SU/SD	none	none	Step the currently selected step function up/down one step.
Step Up/Down Frequency	FU/FD	none	none	Change the current step function to frequency and step frequency up/down one step.
Step Up/Down Amplitude	LU/LD	none	none	Change the current step function to amplitude and step amplitude up/down one step.
Step Up/Down AM	PU/PD	none	none	Change the current step function to AM and step AM up/down one step.
Step Up/Down FM	DU/DD	none	none	Change the current step function to FM and step FM up/down one step.
RF ON/OFF ENTRY				
RF Output	RO	0/1	none	Turn RF output off/on.
SPECIAL FUNCTION ENTRY				
Special Functions	SP	00 02 03 04 07/08 09 10 11 12/13 14 15 20/21 30/31 70 71 72 80 81 82 83-86 90/91		Clears all special functions Initiates self test Display check Key check Set/reset SRQ Display S/W rev and instr ID Display IEEE-488 address Display self-test results Turn on/off display Initialize memory Latch test Disable/enable relative freq Disable/enable relative ampl Medium key repeat rate Fast key repeat rate Slow key repeat rate Enable all level correction Disable all level correction Disable attenuator correction Program alternate 24dB attens Disable/enable ampl fixed ring

IEEE-488 COMMANDS (cont)

COMMAND USE	COMMAND			COMMENTS
	HEADER	NUMERIC	SUFFIX	
SRQ COMMANDS				
Interrogate SRQ Mask	IM	none	none	Interrogate the SRQ mask. The Generator responds with the decimal value of the SRQ mask.
Set SRQ	SM	int	none	The SRQ mask is set to int.
Local Operation Alert Mode	XF	0/1	none	Disable/enable a mode to set SRQ each time a local entry is made. This SRQ is enabled by setting the front panel bit in the SRQ mask.
CLEAR COMMANDS				
Clear IEEE-488 Output Buffer	CB	none	none	Clears IEEE-488 output buffer
Clear error	CE	none	none	Clears the IEEE-488 rejected entry status.
Device Clear	CL	none	none	Clears the instrument state.
EDIT ENTRY				
Position Amplitude Bright Digit	AB	float	V MV UV NV DB	Position the bright digit in the AMPLITUDE display with the stated resolution. For example, enter "AB10MV"for a 10-mV resolution.
Position FM Bright Digit	DB	float	GZ MZ KZ HZ	Position the bright digit in the FM display with the stated resolution. For example, enter "DB1KZ" for a 1-kHz resolution.
Position Frequency Bright Digit	FB	float	GZ MZ KZ HZ	Position the bright digit in the FREQUENCY display with the stated resolution. For example, enter "FB1MZ" for a 1-MHz resolution.
Position AM Bright Digit	PB	float	PC	Position the bright digit in the AM display with the stated resolution. For example, enter "PB1PC" for a 1% resolution.
Edit	KB	float	none	Edit the current bright digit by float counts.
Edit Amplitude	KA	float	none	Move the bright digit to the AMPLITUDE display and edit amplitude by float counts.
Edit FM	KD	float	none	Move the bright digit to the FM display and edit FM by float counts.

IEEE-488 COMMANDS

COMMAND USE	COMMAND			COMMENTS
	HEADER	NUMERIC	SUFFIX	
Edit Frequency	KF	float	none	Move the bright digit to the FREQUENCY display and edit frequency by float counts.
Edit AM	KP	float	none	Move the bright digit to the AM display and edit AM by float counts.
INTERROGATE COMMANDS				
Instrument Identification	ID	none	none	The Generator responds with its model number, for example, "6060A."
Elapsed Time Indicator	IE	none	none	If the Non-Volatile Memory option is installed, the Generator responds with the total operating time since the Generator was manufactured.
Interface Modes	II	none	none	Interrogate the interface modes selected. The Generator responds with an unsigned integer.
Option Loading	IO	none	none	Interrogate the option loading. The Generator responds with the message: d1, d2, d3 d1 is the instrument code. d2 is the digital and synthesizer options. d3 is the output options. See the Interrogate Commands paragraphs* for details.
Rejected Entry	IR	none	none	Interrogates the rejected entry error codes. The Generator responds with three octal fields: "AAAAA,BBBBB,CCCCC." See Table 2-6 for a list of rejected entry error codes.*
Self Test	IT	none	none	Interrogates the results of the self tests. The Generator responds with the self-test results. See paragraph 4D-20 for self-test codes.*
UNCAL	IU	none	none	Interrogates the uncalibrated output error codes. The Generator responds with three octal fields: "AAAAA,BBBBB,CCCCC." See Table 2-5 for a list of uncal error codes.*

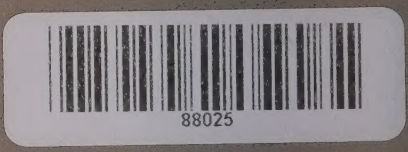
**Refer to table and paragraph numbers in 6060A Manual.*

IEEE-488 COMMANDS (cont)

COMMAND USE	COMMAND			COMMENTS
	HEADER	NUMERIC	SUFFIX	
Software Version	IV	none	none	Interrogate the software version. The Generator responds with the status message: "Vxx.x" where x's are decimal digits representing the current software revision level.
MONITOR COMMANDS				
Input Bit	IB	none	BIT Designator	Respond with the value of the designated hardware bit.
Output Bit	OB	0/1	BIT Designator	Set the designated hardware bit to 0 or 1.
Output Dac	OD	int	DAC Designator	Set the value of the designated hardware DAC to the value specified by int.
Read Byte	RB	int	none	Read the value of the addressed byte. The Generator responds with an unsigned integer.
Read Word	RW	int	none	Read the value of the addressed word. The Generator responds with an unsigned integer.
Define Write Address	DW	int	none	Defines the address to be used by the write byte/word commands.
Write Byte	WB	int	none	Write int into the address specified with the define write address command.
Write Word	WW	int	none	Write int into the address specified with the define write address command.
Read Attenuation	XA	none	none	Read the current attenuation. The Generator responds with an unsigned integer.
Write Attenuation	XB	none	none	Change attenuation to 6dB times the unsigned integer. The integer can be 0 to 23.
Set Frequency Direct	XD	float	GZ MZ KZ HZ	Set the frequency hardware directly to the specified synthesizer frequency.
RF Output	XR	0/1	none	"XR0" programs all attenuation. "XR1" restores attenuation to its previous state.

Table 2-8. IEEE-488 Commands (cont)

COMMAND USE	COMMAND			COMMENTS
	HEADER	NUMERIC	SUFFIX	
MEMORY ENTRY				
Recall	RC	int	none	Recall the front panel setup stored at the memory location specified by int.
Store	ST	int	none	Store the current front panel setup at the memory location specified by int.
Sequence	SQ	none	none	Sequence (recall) to the next higher memory location.
MODULATION ENTRY				
Program AM	AM	float	PC	Program AM depth in percent.
External AM	AE	0/1	none	Disable/enable external AM modulation.
Internal AM	AI	0/1	none	Disable/enable internal AM modulation.
Program FM	FM	float	GZ gigahertz MZ megahertz KZ kilohertz HZ hertz	Program FM deviation in units of:
External FM	FE	0/1	none	Disable/enable external FM modulation.
Internal FM	FI	0/1	none	Disable/enable internal FM modulation.
Program Mod Freq	MR	0/1	none	Program modulation frequency to 400 Hz/1000 Hz.
Program Mod Freq	MF	float	GZ gigahertz MZ megahertz KZ kilohertz HZ hertz	Program modulation frequency in units of:
TRIGGER COMMANDS				
Configure Trigger	CT	string	none	Configures the trigger. Each time a trigger command or a group execute trigger interface message is received, the Generator executes the string of commands. The string record must end with a record terminator.
Trigger	TR	none	none	Trigger command. Equivalent to the group execute interface message. Upon processing the trigger command, the Generator executes the string, which has been preprogrammed with the configure trigger command.



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